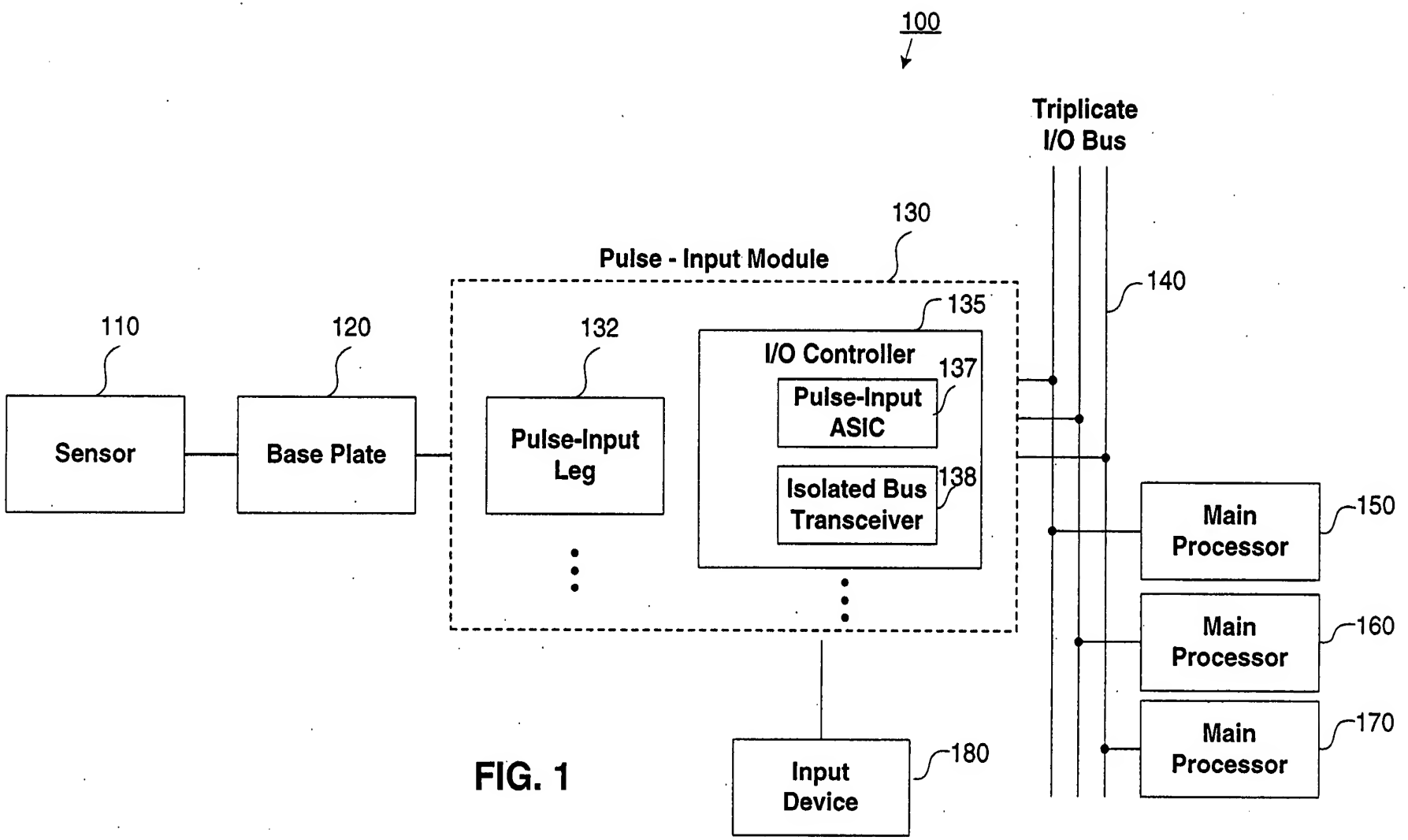
100
Triplicate
I/O Bus
130
Pulse - Input Module
140
135
110
120
132
I/O Controller
137
Pulse-Input
ASIC
Sensor
Base Plate
Pulse-Input
Leg
138
Isolated Bus
Transceiver
Main
Processor
150
Main
Processor
160
Main
Processor
170
Input
Device
180

FIG. 1

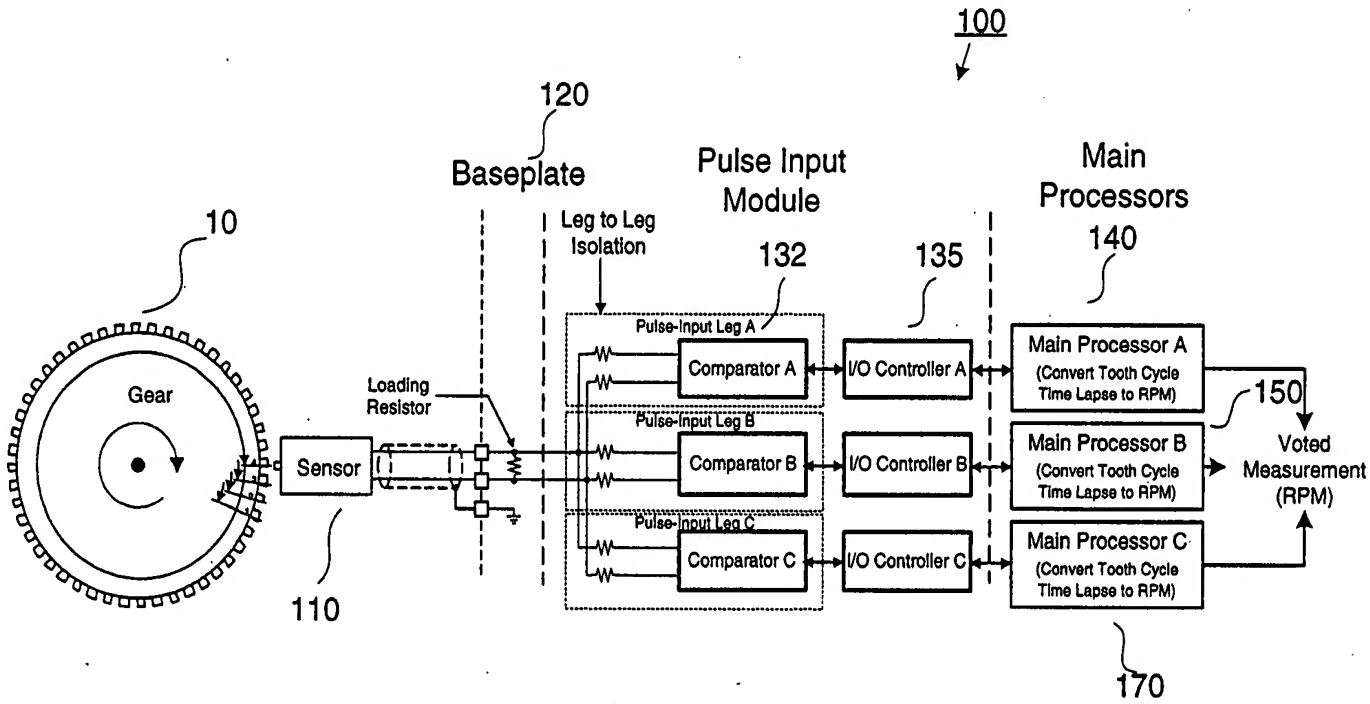
100
120
Baseplate
Pulse Input Module
Main Processors
10
Leg to Leg Isolation
132
135
140
Pulse-Input Leg A
Comparator A
I/O Controller A
Main Processor A
(Convert Tooth Cycle Time Lapse to RPM)
Loading Resistor
Gear
Sensor
Pulse-Input Leg B
Comparator B
I/O Controller B
Main Processor B
(Convert Tooth Cycle Time Lapse to RPM)
150
Voted Measurement (RPM)
Pulse-Input Leg C
Comparator C
I/O Controller C
Main Processor C
(Convert Tooth Cycle Time Lapse to RPM)
110
170

FIG. 2

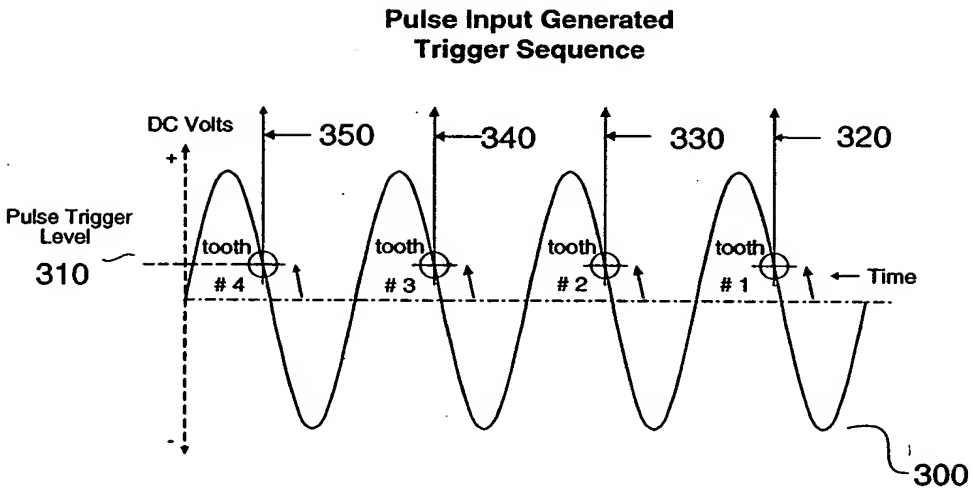
Pulse Input Generated
Trigger Sequence
DC Volts
+
-
350
340
330
320
Pulse Trigger
Level
310
tooth
4
tooth
3
tooth
2
tooth
1
Time
300

FIG. 3

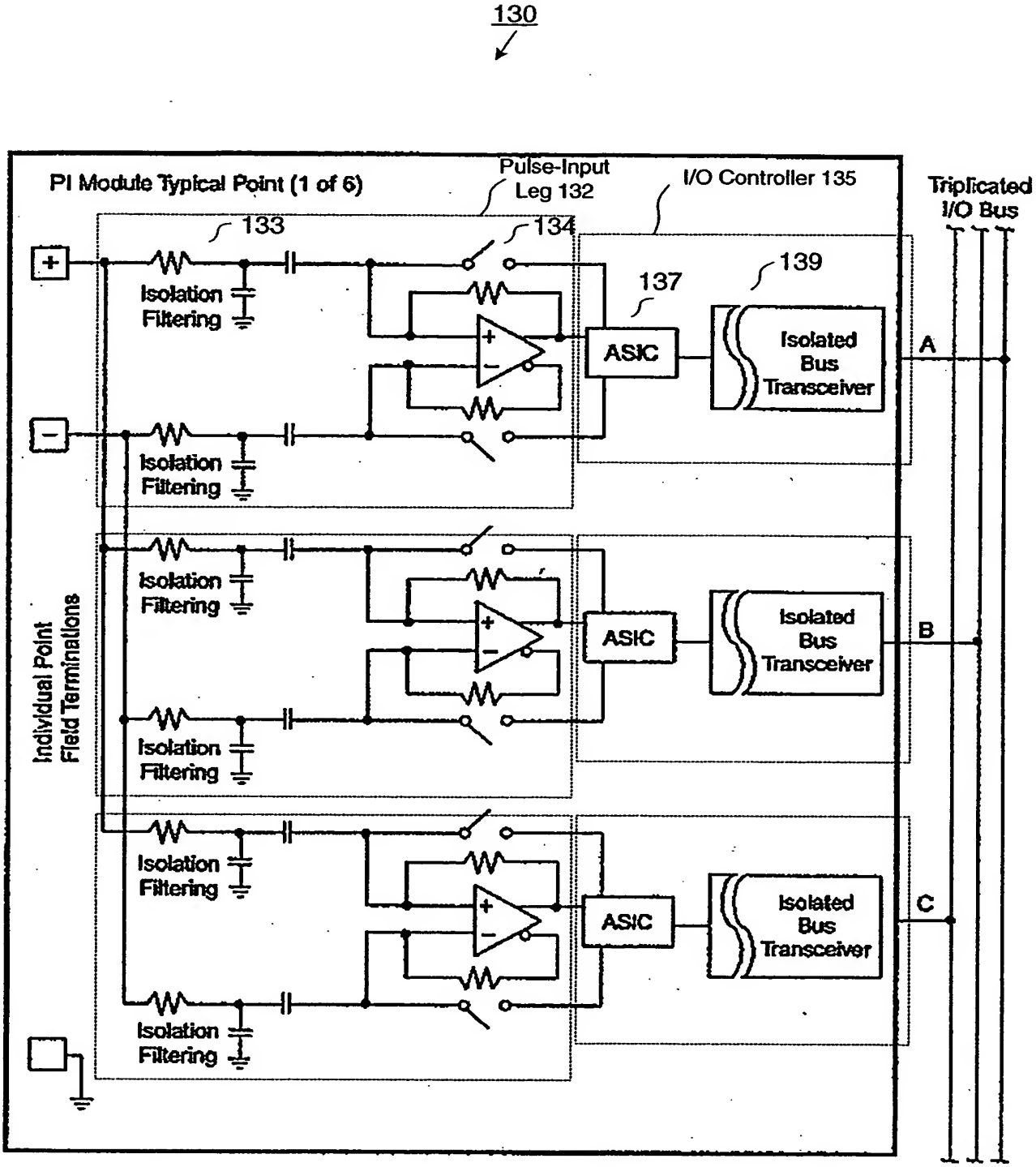
130
PI Module Typical Point (1 of 6)
Pulse-Input Leg 132
I/O Controller 135
Triplicated I/O Bus
133
134
137
139
Isolation Filtering
ASIC
Isolated Bus Transceiver
A
B
C
Individual Point Field Terminations
+
−

FIG. 4

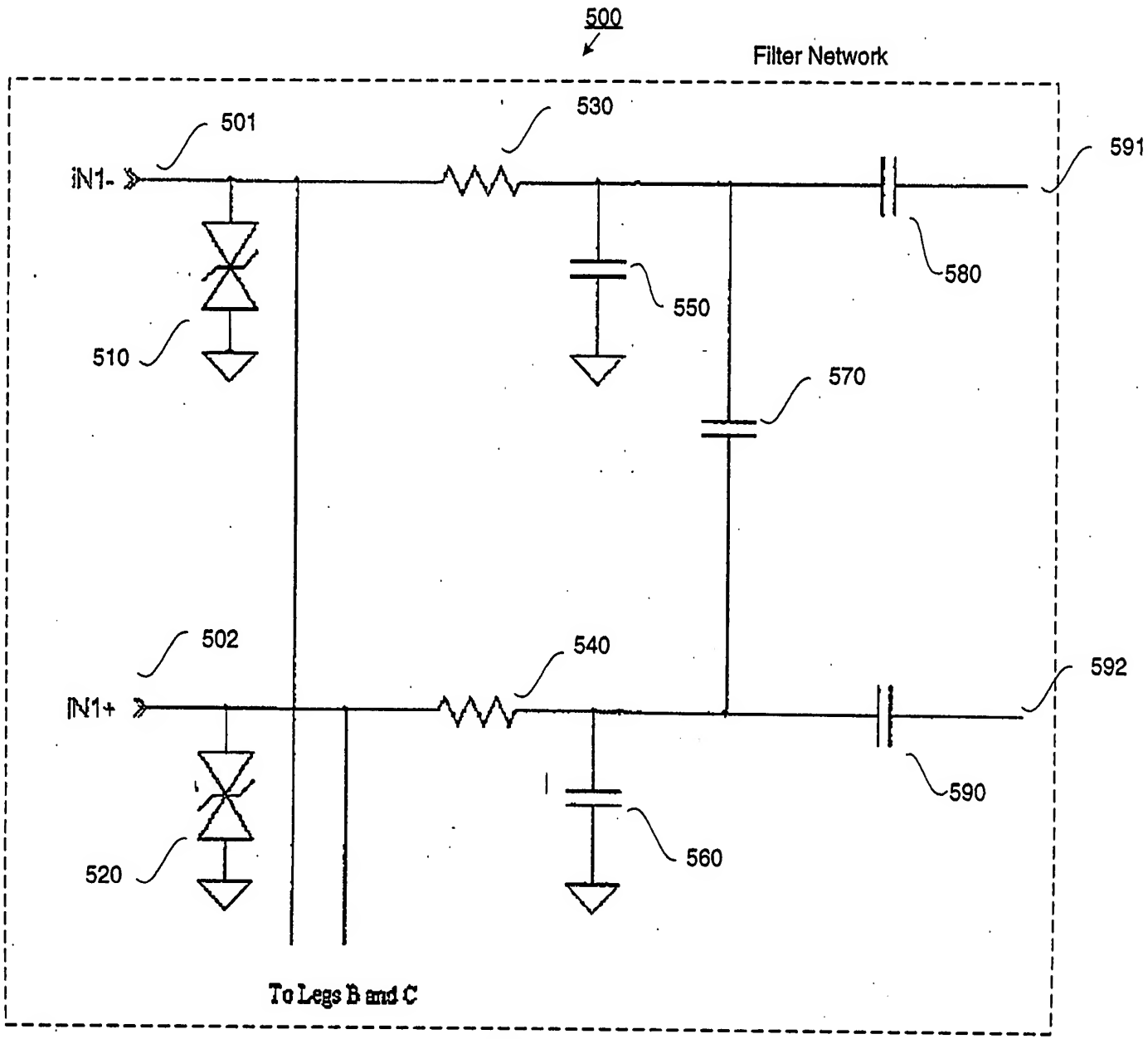
500
Filter Network
501
530
591
iN1-
580
550
510
570
502
540
592
IN1+
590
560
520
To Legs B and C

FIG. 5

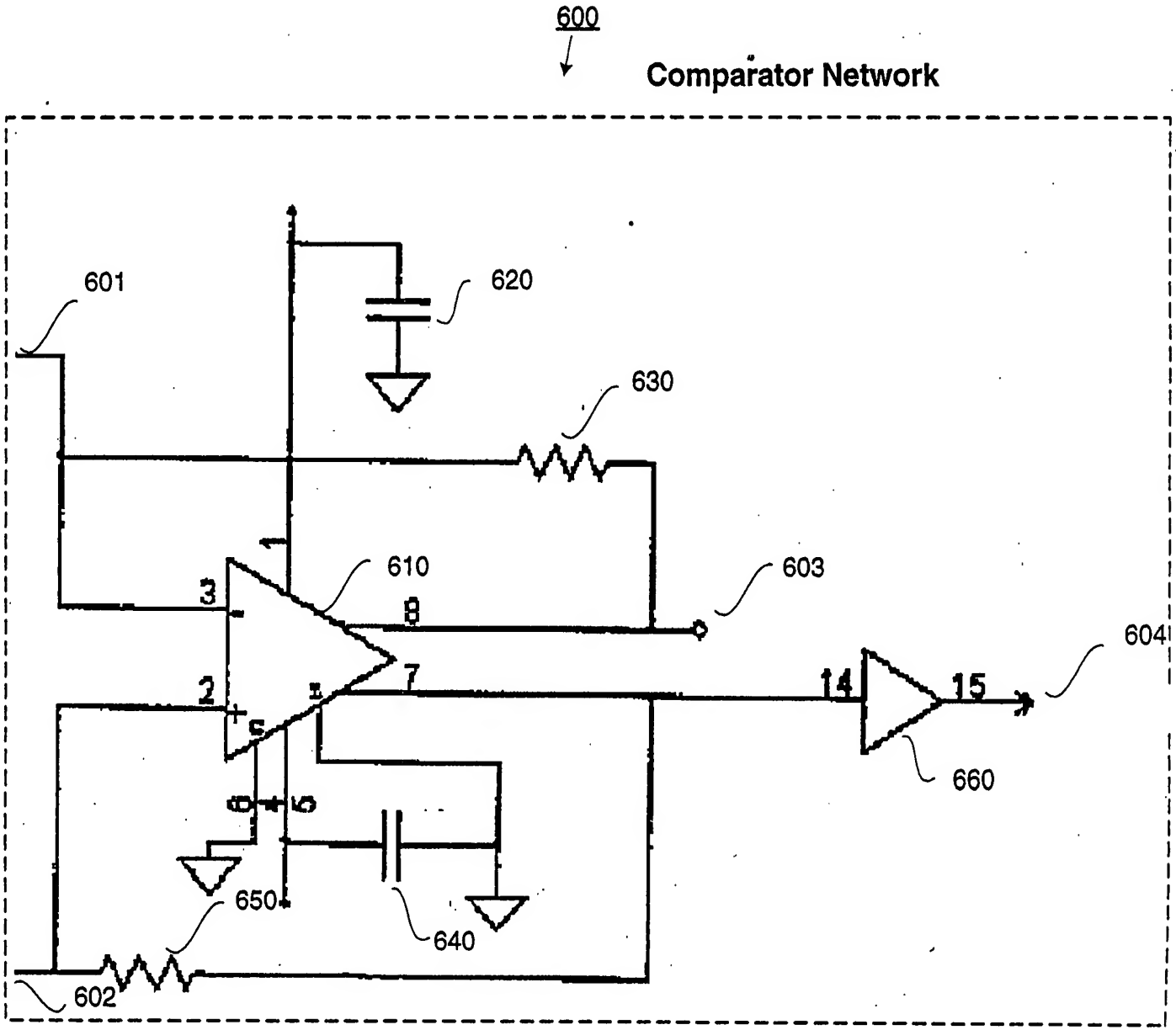
600
Comparator Network
601
620
630
610
603
604
660
650
640
602
1
2
3
5
6
7
8
14
15

FIG. 6

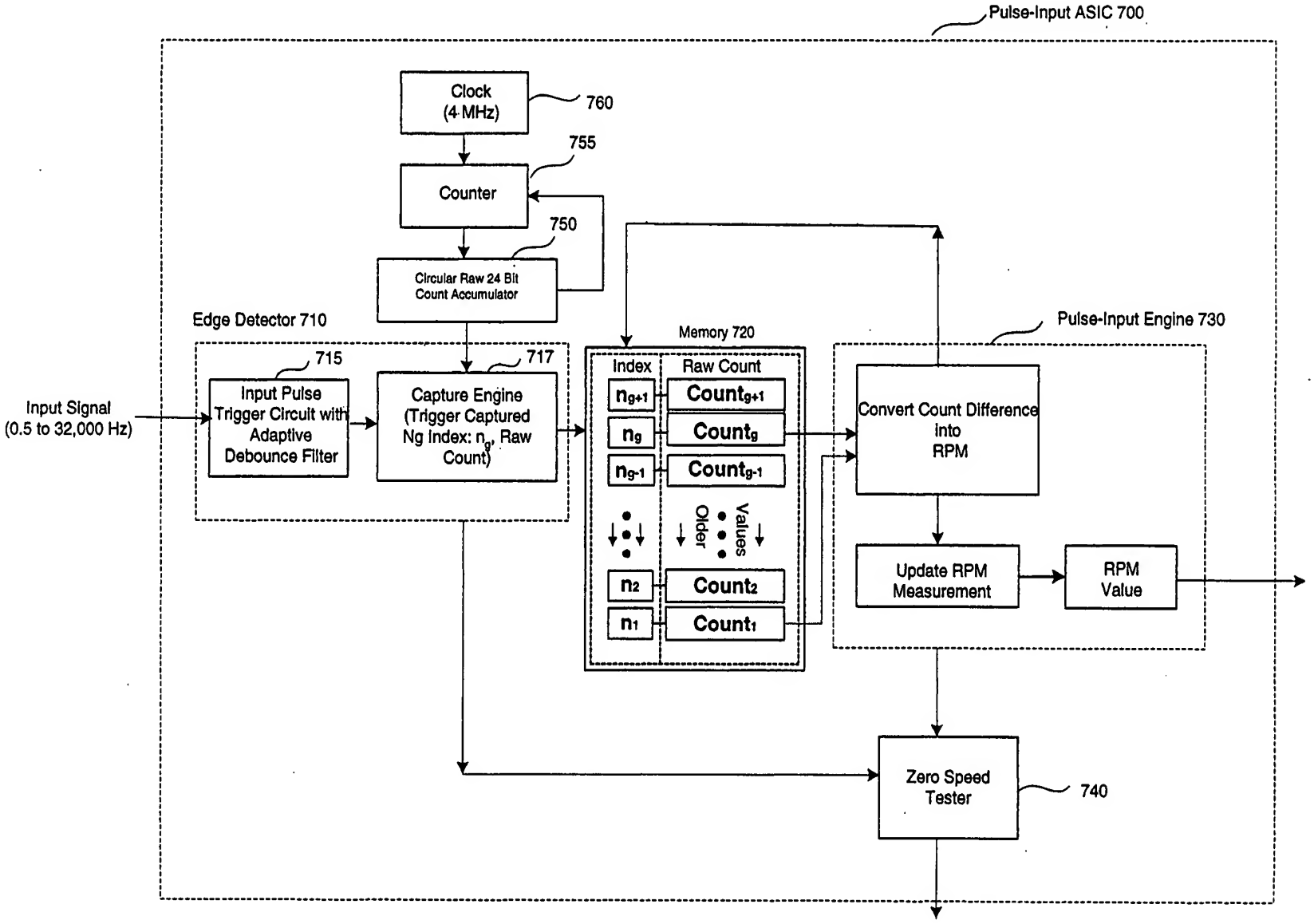
Pulse-Input ASIC 700
Clock
(4 MHz)
760
755
Counter
750
Circular Raw 24 Bit
Count Accumulator
Edge Detector 710
715
717
Input Signal
(0.5 to 32,000 Hz)
Input Pulse
Trigger Circuit with
Adaptive
Debounce Filter
Capture Engine
(Trigger Captured
Ng Index: ng, Raw
Count)
Memory 720
Index
Raw Count
ng+1
Countg+1
ng
Countg
ng-1
Countg-1
Older
Values
n2
Count2
n1
Count1
Pulse-Input Engine 730
Convert Count Difference
into
RPM
Update RPM
Measurement
RPM
Value
Zero Speed
Tester
740

FIG. 7

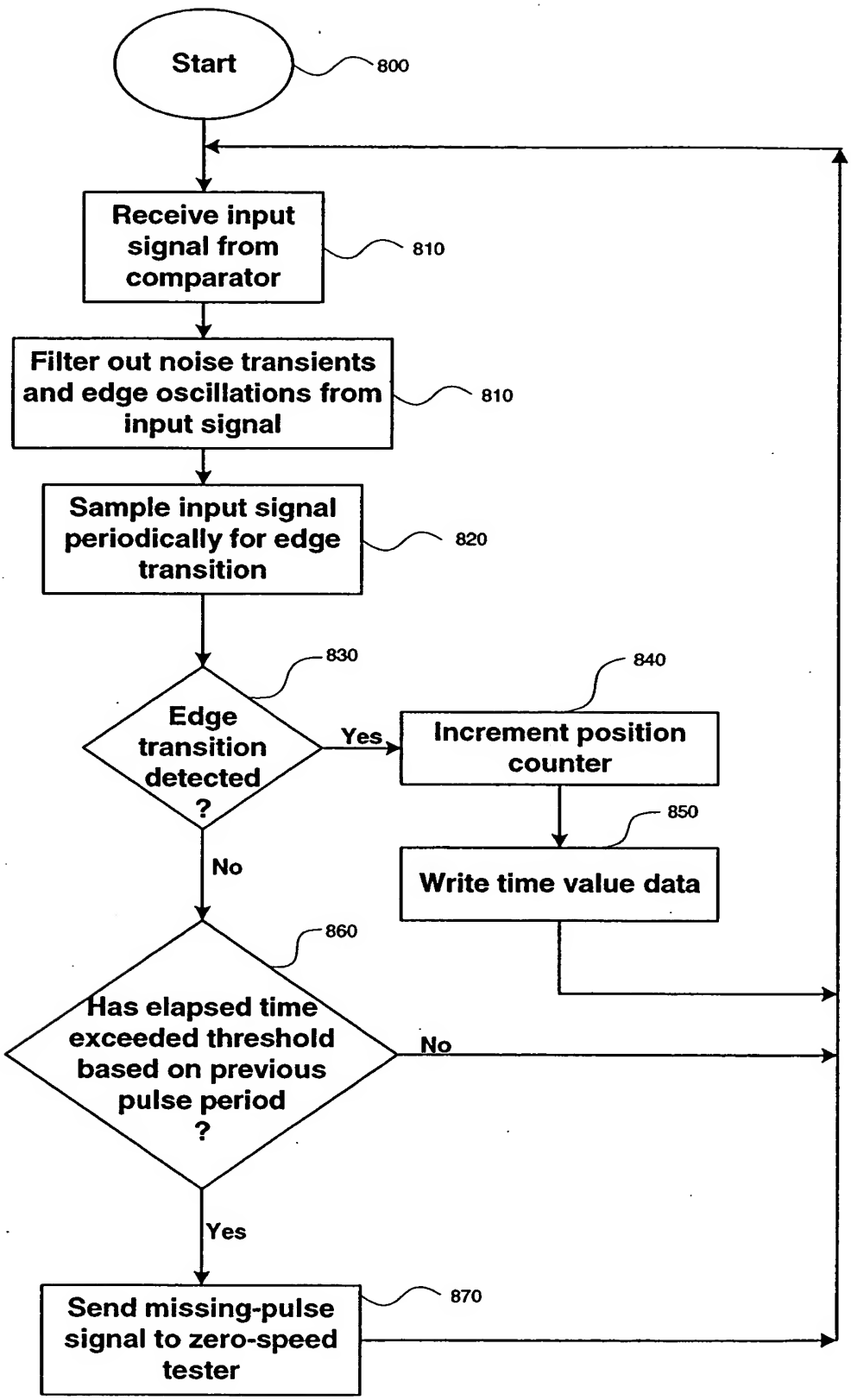
Start
800
Receive input signal from comparator
810
Filter out noise transients and edge oscillations from input signal
810
Sample input signal periodically for edge transition
820
830
Edge transition detected ?
Yes
840
Increment position counter
850
Write time value data
No
860
Has elapsed time exceeded threshold based on previous pulse period ?
No
Yes
Send missing-pulse signal to zero-speed tester
870

FIG. 8

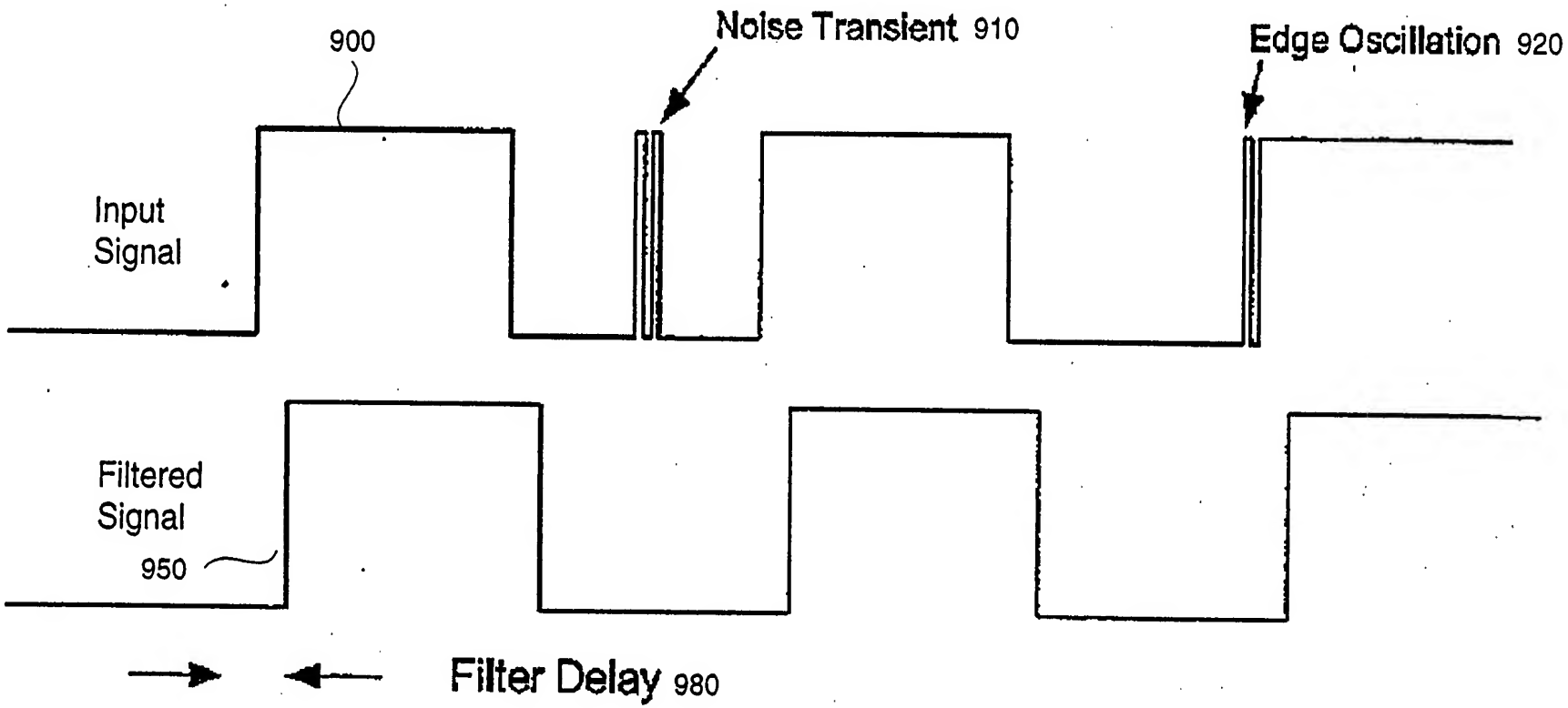
900
Noise Transient 910
Edge Oscillation 920
Input Signal
Filtered Signal
950
Filter Delay 980

FIG. 9

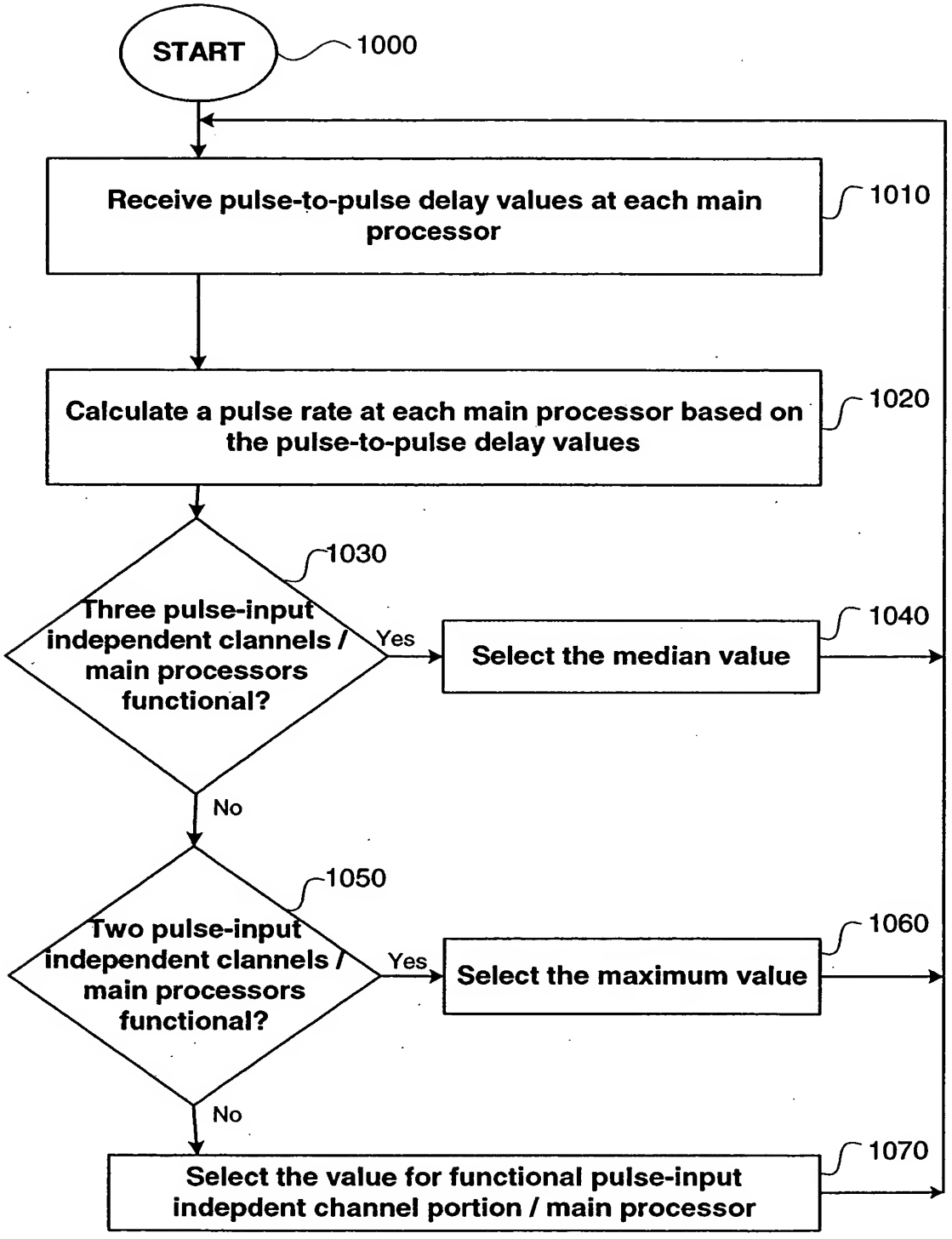
START
1000
Receive pulse-to-pulse delay values at each main processor
1010
Calculate a pulse rate at each main processor based on the pulse-to-pulse delay values
1020
1030
Three pulse-input independent clannels / main processors functional?
Yes
Select the median value
1040
No
1050
Two pulse-input independent clannels / main processors functional?
Yes
Select the maximum value
1060
No
Select the value for functional pulse-input indepdent channel portion / main processor
1070

FIG. 10